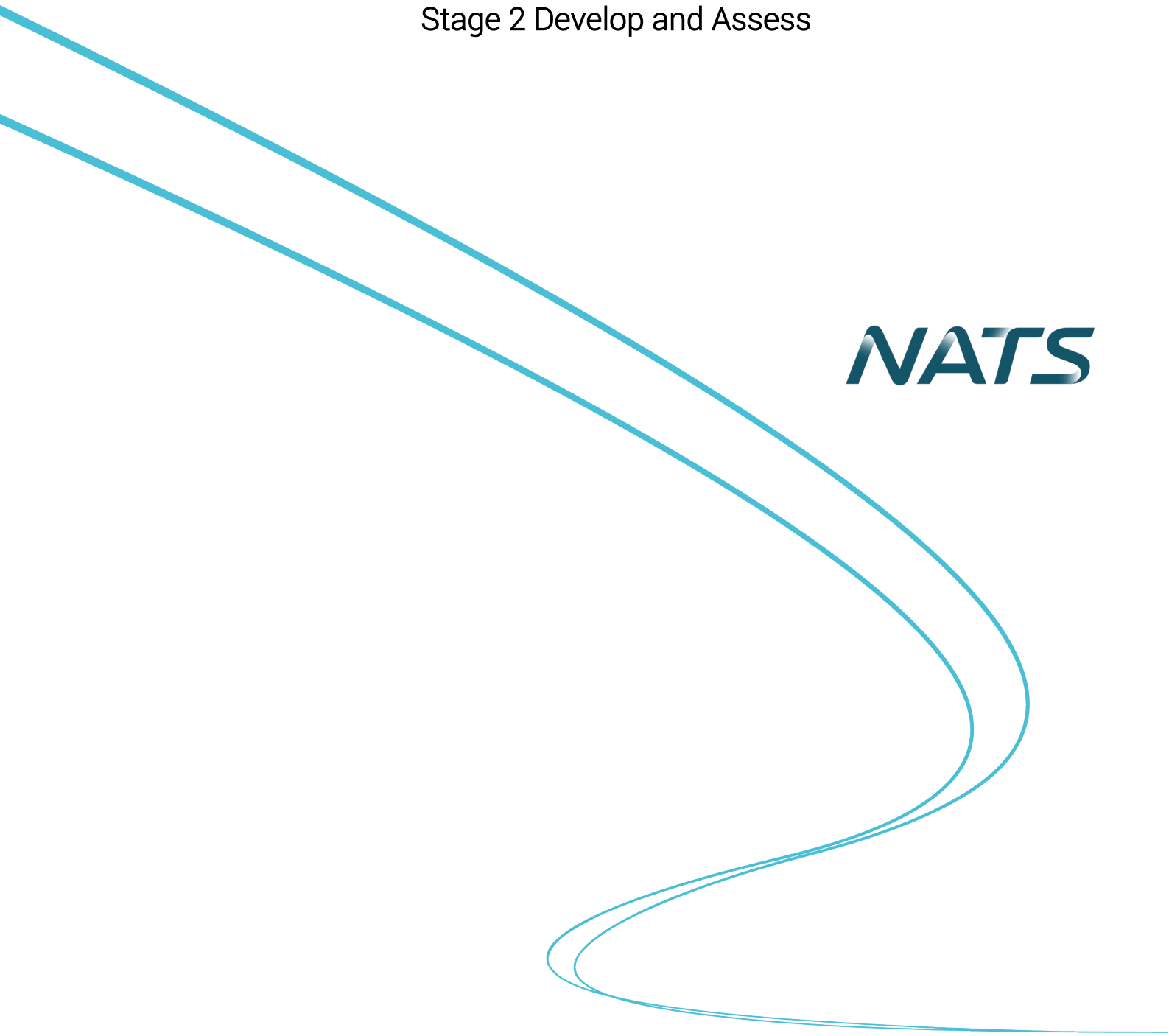
Free Route Airspace Deployment 3

Airspace Change Proposal (ACP)
ACP-2021-071

Gateway documentation:
Stage 2 Develop and Assess



Roles

Action	Role	Date
Produced	**Airspace Change Specialist** NATS Airspace & Future Operations	March 2023
Reviewed Approved	**Manager Airspace Evolution & Planning** NATS Airspace & Future Operations	April 2023
Reviewed Approved	**Airspace Development Consultant** NATS Airspace & Future Operations	April 2023
Reviewed Approved	**FRA Project Manager** Operations & Airspace Programme Delivery	April 2023

Drafting and Publication History

Issue	Month/Year	Changes this issue
1.0	April 2023	Submitted to CAA

Contents

References

1. CAP1616: CAA Airspace Change: Guidance on the regulatory process
2. CAP1711: CAA Airspace Modernisation Strategy
3. EUROCONTROL ERNIP Part 1
4. ACP-2018-11 Free Route Airspace, Deployment 1 - link to CAA portal page
5. ACP-2019-12 Free Route Airspace, Deployment 2 – link to CAA portal page
6. ACP-2020-39 Free Route Airspace, Deployment 2.1 – link to CAA portal page
7. ACP-2021-071 Free Route Airspace, Deployment 3 – link to CAA portal page
8. ACP-2021-072 Free Route Airspace, Deployment 4 – link to CAA portal page
9. UK Aeronautical Information Publication
10. EUROCONTROL NM Flight Planning Requirements – Guidelines (Dec 2022)

1. Introduction

1.1 This document aims to provide adequate evidence to satisfy CAP1616 (Ref 1) Stage 2 Develop and Assess Gateway:

- Step 2A Options Development: Design Options & Design Principle Evaluation
- Step 2B: Options Appraisal: Initial Options Appraisal

1.2 This Airspace Change Proposal (ACP) is the third deployment of Free Route Airspace (FRA) in UK airspace. The implementation of FRA was mandated in European Law[1] and it is a key component of the Airspace Modernisation Strategy (AMS) (Ref 2).

1.3 The changes proposed in this ACP impact flights above FL255. Hence in accordance with the Levels as defined in CAP1616, it is expected that this proposal would be categorised as a Level 2B change.

2. Background and Scope

2.1 FRA is defined as "A specified airspace within which users may freely plan a route between a defined entry point and a defined exit point, with the possibility to route via intermediate (published or unpublished) waypoints, without reference to the Air Traffic Services (ATS) route network, subject to airspace availability." (EUROCONTROL, ERNIP Part 1, Ref 3). Within this airspace, flights remain subject to air traffic control.

2.2 The requirement to implement FRA was mandated in European legislation (Single European Sky ATM Research, Pilot Common Project (SESAR PCP) Implementing Regulation EU716/2014). The SESAR PCP ATM Functionality 3 (AF3) states that Free Route shall be provided and operated in the airspace for which the Member States are responsible at and above Flight Level 310 in the International Civil Aviation Organisation, European Region (ICAO EUR) by 1st January 2022 (see Footnote 1 for UK update following departure from the European Union). In response to this, NATS undertook to implement Free Route Airspace in a phased manner across UK airspace.

2.3 The initial FRA Statement of Need (SoN) submitted to the CAA proposed to introduce FRA throughout the UK. Following the Assessment Meeting and initial work on Design Principles and options development, it became apparent that the scale of the ACP, in particular the length of time required to implement FRA in phased geographical deployments[2], did not easily align with the engagement and consultation requirements of the ACP process. Therefore, the decision was taken to submit individual ACPs for each planned deployment of FRA. FRA Deployment 1 (FRA D1) (Scottish) and FRA D2.1 (PEMAK Triangle / TAKAS Box) were implemented in December 2021[3]. FRA Deployment 2 (FRA D2) (West) was implemented in March 2023. Current FRA is shown in Figure 1.

2.4 For the third and fourth deployments (FRA D3 & D4), the intention was to introduce FRA, and associated changes to the underlying airspace structure, from the current Scottish FRA border, south across several airspace sectors over two deployments a year apart. The SoNs and Design Principles were developed for both FRA D3 and FRA D4, with a combined engagement activity undertaken for CAP1616 Stage 1 (Ref 6&7). The intention was to complete simultaneous Stage 2 Options Development work and Stage 3 Consultation for both D3 and D4, to reduce stakeholder fatigue and minimise costs.

[1] The implementation of FRA by European Union (EU) member states was mandated in European law under the EU Implementing Regulation EU716/2014 (Pilot Common Project). EU716/2014 has been superseded by EU2021/116 (Common Project 1) within the EU. This change to the regulation occurred post-UK withdrawal from the EU. EU716/2014 is retained (and amended in UK domestic law) under the European Union (Withdrawal) Act 2018 (referred to as 'the mandate' throughout this document).

[2] The implementation of FRA was assessed against influencing factors, such as system requirements, simultaneous airspace modernisation projects (LAMP, ScTMA etc) traffic flow complexity, Borealis Alliance commitments and the requirements of neighbouring ANSPs. The results of which necessitated a geographically phased implementation to enable the introduction of FRA within the PCP timescales.

[3] FRA D2.1 covers UK airspace with ATS provision delegated to (DSNA) France and (IAA) Ireland. It was initially included in the scope of D2, but it became a separate ACP (D2.1) in order to align with DSNA and was implemented with D1 in December 2021. For the purposes of programme management, this current ACP is still considered the 'third deployment' of FRA albeit it is the 4th FRA area in UK airspace.

2.5 However, the implementation of FRA D3 and D4 is constrained by technological limitations linked to the ATC operational centres serving Scottish (Prestwick) and London (Swanwick) UIRs. Whilst current ATC Systems are compatible between the centres, they are not sufficiently integrated to safely undertake cross-centre FRA operations. This is dependent upon a new technology platform (Deployment Point – En Route), which will enable the system requirements[4] for cross centre FRA operations. To expedite the delivery of additional FRA and enable improved environmental and economic benefits to UK airspace users, NATS proposes to implement FRA within the Prestwick Centre Upper operation only for Deployment 3 and has paused D4.

2.6 A revised SoN (v2) limits the proposed lateral area for this deployment to airspace which aligns with the current Area of Responsibility for the NATS Prestwick Centre Upper operation:

In response to the CAP1711 Airspace Modernisation Strategy, NATS is progressing to implement Free Route Airspace (FRA) in a phased manner across UK airspace. This ACP proposes the introduction of the third deployment of FRA and associated changes to the underlying structure.

The boundary of FRA D3 will align with the current Area of Responsibility of our Prestwick Centre Upper operation. This will produce a single FRA volume north of 54N extending into the North Sea to encompass our Humber sector. (Statement of Need v2; FRA D3, Ref 7)

2.7 The purpose of this change is to deliver against the legal mandate for FRA, and to meet UK-ABN/1 of the AMS - implementing FRA involves the removal of high-level route structures, supported by flexible use of airspace management techniques that segregate operations where necessary. This will enable environmental efficiencies, through reduced CO_2 and reduced fuel burn.

2.8 Figure 1 shows current FRA within UK airspace (D1, D2.1 & D2), and the proposed D3 change area.

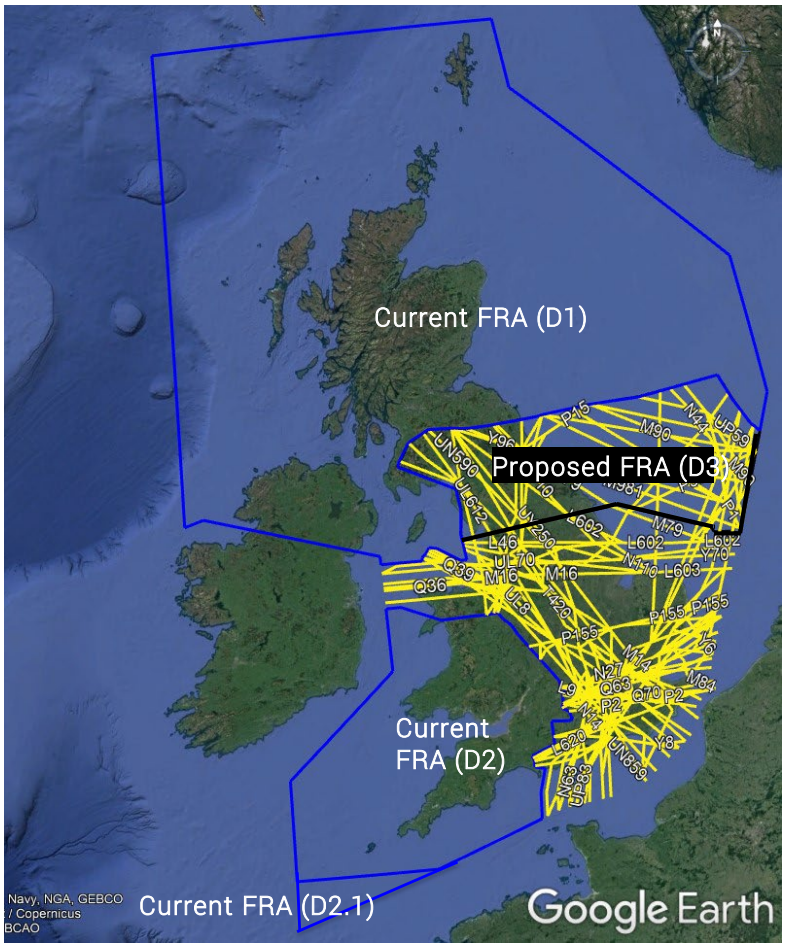


Figure 1 Current FRA airspace and indicative proposed D3 deployment area

[4] Requirements of the supporting ATC tools and engineering systems

2.9 NATS has engaged significantly on the implementation of FRA within UK airspace for several years. This is fully described in the ACPs for Deployments 1, 2 and 2.1 (Ref 4, 5 & 6) and forms the basis for this ACP. This is the 3rd deployment of FRA within UK airspace, with largely the same stakeholders and no impact to those on the ground, given the altitude of the proposed changes.

2.10 For this deployment, we have scaled the Stage 2 engagement activity on proposed design options to targeted emails to stakeholders engaged with at Stage 1. We believe this is proportional given the extensive prior engagement, previous deployments and the changes all being at FL245 and above. Specific activity is described in Section 4 Option Development.

3. Baseline (do nothing) description

3.1 In 2020, there was an unprecedented drop in demand for air travel due to the COVID-19 pandemic. Whilst traffic levels are returning, they have fluctuated throughout the pandemic and 2019 is generally still deemed the most credible data to use as a baseline for traffic levels.

3.2 However, the implementation in December 2021 of FRA Deployment 1 in Scottish airspace has affected traffic flows in the airspace impacted by this change proposal. 2022 traffic data is therefore utilised as the baseline. It is the most credible and up to date data for this region and removes the possibility of double accounting for environmental savings from FRA D1 implementation.

3.3 It should be noted that "Doing nothing" is useful as a baseline for comparison, but due to the legal mandate to implement FRA it is not considered as a viable option.

Current Airspace

3.4 The baseline traffic figure for flights transiting this airspace is 447,283 per annum (2022 traffic).

3.5 Figure 2 shows the current upper airspace and ATS route network. The change area interfaces with current FRA (D1, airspace above the top blue line) and extends below to the black line, which is the boundary line for the upper Area of Responsibility for Prestwick ATC centre. The airspace comprises both the Scottish Upper Flight Information Region (UIR) and London UIR (red lines). This airspace also interfaces with Dutch Airspace (Amsterdam UIR), with ATS provision provided by Maastricht Upper Area Control (MUAC). Maastricht already operate FRA on this boundary at FL250+.

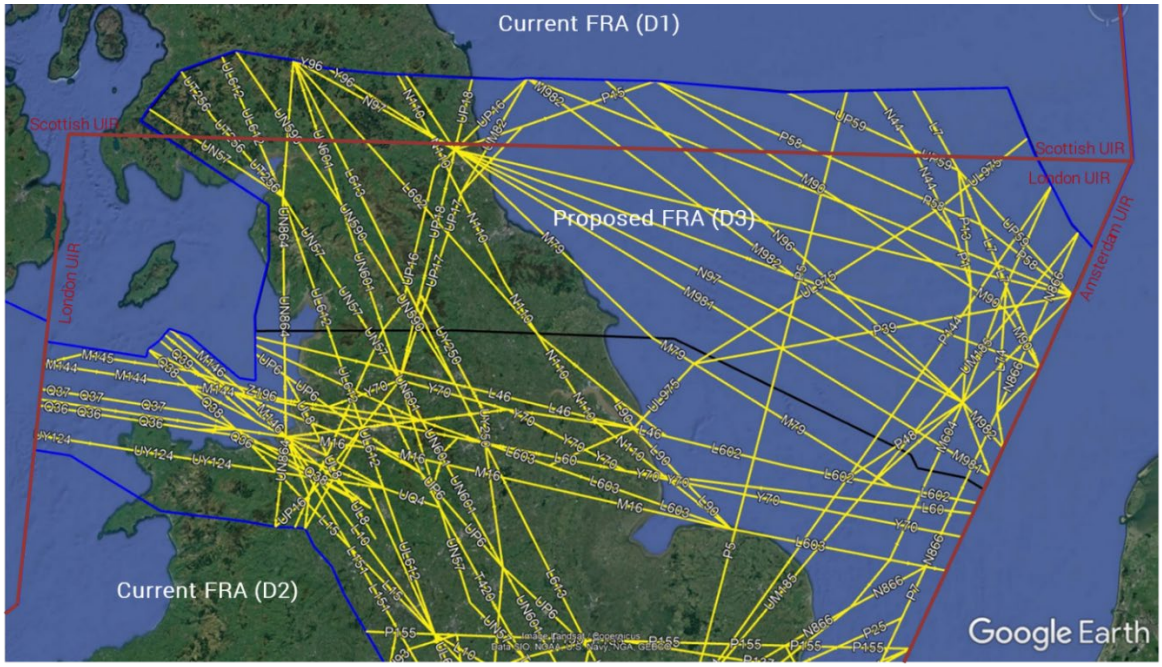


Figure 2 Current UIR airspace/routes within FRA Deployment 3 area

3.6 Currently all aircraft flight plan the published ATS route structure or on published Direct routings (DCTs - trajectories between specified waypoints). Satellite navigation technology now makes navigation between any points possible.

3.7 Air traffic control (ATC) routinely instruct aircraft to route direct to a point (termed a tactical direct) to improve efficiency as aircraft transit through UK upper airspace. The use of the designated entry/exit points (termed coordination points (COPs)) at the UIR boundary, and the ATS route structure can be seen in Figure 3. This diagram shows current flight-path density plots (2022 data), presenting the typical busy flows of traffic in the upper airspace in the proposed deployment area.

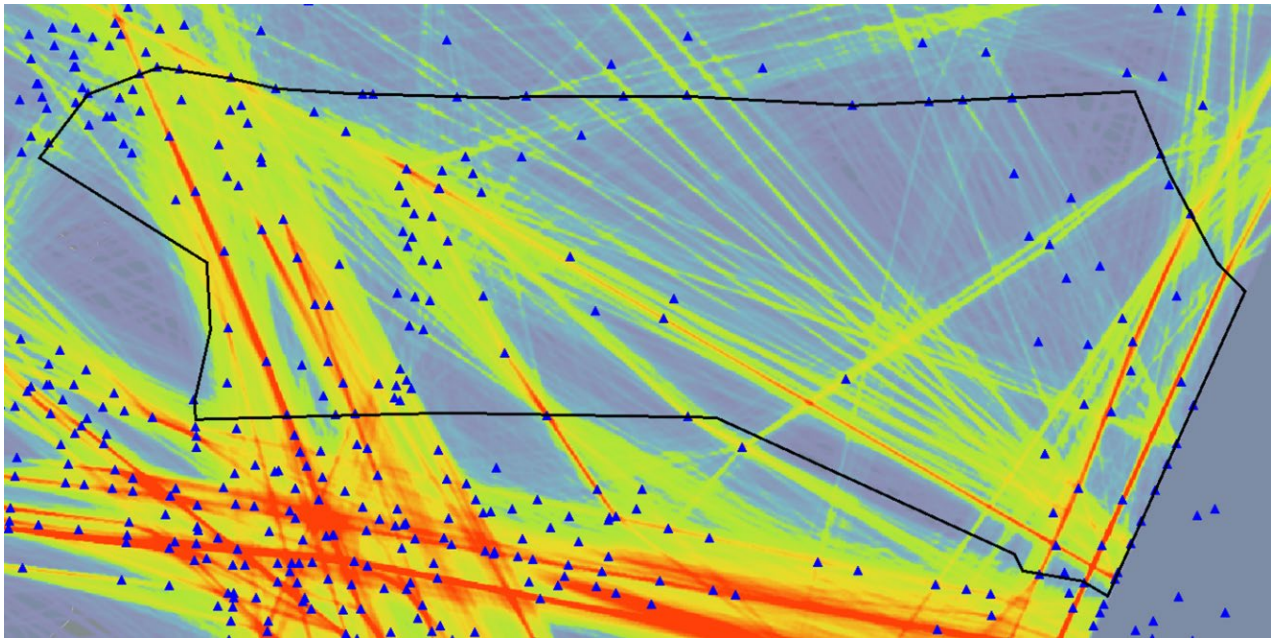


Figure 3 Typical current day traffic flows in FRA D3 region (above FL255) 8-14 August 2022

3.8 For reference the extant UK route structure is defined in detail in the UK AIP (Ref 9): ENR 3.2 UPPER ATS ROUTES

4. Design options

Background

4.1 Since this change is mandatory under UK law and an agreed strategic aim of the Single European Sky initiative, the options developed in previous deployments have been limited to the following:

- Option 0: Baseline: do nothing – maintain the current high level ATS route structure.

  Implement FRA in accordance with Implementing Regulation EU716/2014 (as revised by UK Law).
- FRA Option 1. In which all ATS routes are removed.
- FRA Option 2. In which the ATS route structure is partially retained.
- FRA Option 3. In which the ATS route structure is retained, but aircraft are not constrained to flight plan the routes within the FRA.

4.2 These options were developed from the mandated FRA PCP requirements and their development is described in detail in the Stage 2a(i) documents for FRA D1 and FRA D2 (REFs 4 & 5).

4.3 Engagement and consultation with stakeholders for previous deployments resulted in 'Option 1 All ATS routes removed' being implemented in both FRA D1, FRA D2.1 and FRA D2 deployment areas.

Option Development

4.4 This proposal is adjacent to the FRA D1 airspace. NATS propose that the construct of FRA D3 must be compatible with the design and methodologies used in FRA D1 to ensure a contiguous volume with the same flight planning principles and requirements. This means upper airspace controllers and airlines would be operating using a single concept of operation, minimising complexity, maximising efficiencies and ensuring the highest levels of safety.

4.5 As such, NATS propose there is only one design option for this FRA deployment – Option 1 Remove all upper routes and implement FRA. This is consistent with all current UK FRA due to the need to apply a common FRA concept of operations (CONOPS).

4.6 The proposed deployment area for FRA D3 is depicted in Figure 2. The boundary is the upper airspace boundary of responsibility between the NATS ATC Centres at Swanwick and Prestwick. As described in 2.5 the boundary is currently constrained by ATC technological factors which limits the deployment of FRA across Centre boundaries.

4.7 Whilst current ATC Systems are compatible between centres, they are not sufficiently integrated to safely undertake cross-centre FRA operations. The implementation of the new technology platform will address this and facilitate the final further FRA deployments across UK airspace at a later date.

4.8 The vertical boundary will be commensurate with FRA D1, with FRA implemented above FL255.

4.9 Currently, this is the maximum area of upper airspace that can be included within this proposal for technical and safety reasons. We propose to implement FRA to this extent to maximise the potential benefits within the constraints of this deployment.

4.10 The underlying route structure will be revised as required. This may require some lower-level routes being extended from FL245 to FL255 to ensure connectivity to the FRA airspace, as was undertaken and approved for FRA D1.

4.11 Computer modelling simulations have been completed to inform the initial benefits assessment for the proposed change. FRA Development Simulations have been undertaken. The traffic samples used are provided by European Network Manager, modelling the activity of FRA D3 volume. These simulations have military engagement, with Defence Airspace & Air Traffic Management (DAATM) in attendance and 78 Squadron participating. These simulations best inform control procedures associated with changes in aircraft trajectories.

4.12 In line with PCP Requirement 8 and ABN/1, flight plan trajectories will need to be managed to maintain a safe distance from Special Use Airspace (SUA). FRA D1 and FRA D2 has implemented Flight plan Buffer Zones (FBZs) around SUA within FRA. For this deployment, NATS will work closely with DAATM to utilise FPZs as required within the deployment area, utilising the parameters as per D2 deployment. Further detail on this will be provided at Stage 3.

4.13 No Planning Zones (NPZs) have been utilised with previous FRA deployments, to restrict flight plans and manage traffic flows. At this stage it is not anticipated we will require additional NPZs for this deployment, however this will be confirmed following further simulation activities as the final design progresses.

Stakeholder Engagement – We Asked, You Said, We Did

4.14 At Stage 1, we conducted a joint engagement with stakeholders on the Design Principles for FRA D3 and FRA D4. Some of those stakeholders would not be impacted by the FRA D3 deployment area, so they have been removed from the stakeholder list for this ACP. We wrote to these stakeholders to advise them of this, and they were able to 'opt in' if they did still wish to be engaged with[5].

[5] One stakeholder responded to 'opt-in', who were already on our D3 list but with an alternative email address (MAG).

4.15 For this Stage, we emailed targeted stakeholders, describing the single design option and the proposed deployment area, and asking for their views on this single design option, with a response form. We asked: "NATS proposes there is only one design option for FRA D3: Option 1 – Remove all upper routes and implement FRA. Do you agree?" (Yes/No). Please provide text supporting your response.

4.16 Emails were sent on 9 February 2023 to stakeholders including National Air Traffic Management Advisory Committee (NATMAC) contacts, Air Navigation Service Providers (ANSPs) adjacent to the change area, relevant airlines, airports and computer flight service providers (CFSPs).

4.17 A response date of 9 March was set, giving stakeholders 4 weeks to consider and respond. This was considered proportionate given the single option and the extensive prior engagement on FRA. A reminder email was sent on 3 March to those who had not responded. A list of all targeted stakeholders is included in Appendix A and evidence of this scaled Stage 2 engagement activity is provided as supplementary document Annex A: Engagement Material.

4.18 16 stakeholders completed the feedback form, and all state they support the single design option. Table 1 below shows the comments which some stakeholders also provided. One stakeholder indicated they did not support the single option and provided commentary; further engagement has clarified the single option and they have subsequently indicated support.

Organisation	Response to design option:	Please supply text supporting your answer to Q1.	NATS Response
Boeing/ Jeppesen	Agree	Nothing additional.	Thank you for your response
BA Cityflyer	Agree	LIDO must be engaged as part of the deployment - whilst you have a link with Jeppesen, LIDO provides >75% of Airlines that operate in the UK. This has been discussed as part of the Scottish implementation washup but must now be made a reality.	Thank you for your response LIDO / Lufthansa are on our contacts list and have been engaged with.
British Gliding Association	Agree	Presuming the upper TRA(G) is unaffected, and we retain the ability to occasionally get a clearance above FL255 if SSR equipped, we don't see a problem.	Thank you for your response This proposal would not impact the TRA(G)
CAE Flight planning	Agree	Agree with common approach for all FRAs design.	Thank you for your response
Edinburgh Airport	Agree	Edinburgh Airport are fully supportive of this proposal and would like to see its implementation as soon as possible. The benefits of FRA far outweigh the current alternative.	Thank you for your response
Emirates	Initially stated Disagree Amended to Agree	Our recent experience suggests that there continue to be significant shortcomings with respect to ATS provision in areas where ATSOCAS service is provided by Swanwick Military. Removing all AWYs and switching to FRA may result in further difficulties for CFPs and global operators like Emirates to correctly apply flight planning limitations. We believe that first and foremost the lack of publications covering ATS availability must be addressed (not through the website, but through standard means of publications) before FRA expansion in D3.	NATS wrote to Emirates and responded to all the issues raised. These issues, whilst important, are not directly linked to the question asked about FRA D3. Emirates responded to our email confirming they are in support of the proposed single option
Etihad	Agree		Thank you for your response

Eurocontrol Maastricht UAC	Agree	MUAC agrees that the structure should be the same in the FRA D1 and D3 volumes.	Thank you for your response
GATCO	Agree	It is disappointing that the Flight Planning Systems do not currently allow a full implementation of FRA across the UK and particularly between the Scottish and London FIRs. GATCO looks forward to receiving a revised timetable detailing the progress of the technology programme to enable this implementation.	Thank you for your response
Leeds Bradford Airport	Agree	FRA has no impact on LBA operations. Therefore supportive.	Thank you for your response
Loganair	Agree	We have no issues with upper routes being removed and FRA being implemented.	Thank you for your response
Lufthansa Systems Poland (LIDO)	Agree	I support to remove AWYs but all depends how restrictive and how complex RAD publication will be.	Thank you for your response
Manchester Airports Group (MAG)	Agree	Yes no issues with this ; it may well assist our POL deps	Thank you for your response
Ministry of Defence (MOD)	Agree	No further comment at this stage.	Thank you for your response
NAVIAIR	Agree	By implementation of FRA no routes are needed.	Thank you for your response
NetJets Europe	Agree	As the world's largest Business Aviation operator we are strong advocates of FRA and have experienced the advantages first hand, particularly with our North American Operation. Direct routing where available (normally due traffic) supports lower fuel burns as well as time savings for our owners. Our aircraft fly normally in the FL430 to FL450 range (subject to ATC flows and sector length) where other traffic is not normally encountered. Some European ATC environments not supporting FRA often enforce a route structure where we could otherwise benefit from FRA. I would hope that this area will be sufficiently resourced to allow (as much as possible) unrestricted climbs and ' normal' or later descent clearances to maximise the benefit of FRA.	Thank you for your response

Table 1 Stakeholder responses to targeted engagement activity

Design Options

4.19 No feedback has been provided which has influenced the design option at this stage. We therefore propose that there is only one viable design option for this deployment, which meets the Statement of Need for this change and is supported by our stakeholders:

- To deploy FRA with all ATS routes removed, above FL255, in the proposed deployment area.

4.20 This completes the Stage 2ai requirements for Design Options & engagement summary. The next section completes Stage 2aii Design Principle Evaluation, where this option will be assessed, along with the baseline (do nothing), against the Design Principles.

5. Design Principle Evaluation

5.1 Table 2 below describes the Assessment Criteria we used to evaluate the design options against the DPs.

Design Principle			Qualitative Assessment Criteria		
Ref	Description	Priority	Met	Partial	Not Met
DP0	**Safety** Maintain or enhance current levels of safety	A	No safety concerns	Some safety concern	Significant safety concern
DP1	**Operational (Resilience)** The proposed airspace will maintain or enhance operational resilience of the ATC network	B	Resilience permanently enhanced or maintained	Resilience temporarily enhanced or maintained	Resilience reduced
DP2	**Economic (Network Performance)** The proposed FRA airspace will facilitate optimised network economic performance	B	Network optimised for economic performance	Network temporarily or partially optimised for economic performance	Network not optimised for economic performance
DP3	**Environmental (CO_2 Emissions)** The proposed FRA airspace will facilitate the reduction of CO_2 emissions per flight	B	Average CO_2 per flight reduced	No change to average CO_2 per flight	Average CO_2 per flight increased
DP4	**Environmental (Impact to Stakeholders on the Ground)** Minimise environmental impacts to stakeholders on the ground[6]	C	Minimal Impact to stakeholders on the ground	Some impact to stakeholders on the ground	Significant impact to stakeholders on the ground
DP5	**Operational (Optimised Trajectories)** Create an environment within which Aircraft Operators (AOs) may freely flight plan optimised trajectories between defined entry and exit points	B	AOs can freely flight plan through FRA	AOs can freely flight plan through FRA but subject to some structural limitations or time constraints	AOs are unable to freely flight plan through FRA
DP6	**Technical (Interface)** The interface between FRA and the ATS route network will be optimised for safety	A	The interface between FRA and the ATS route structure is optimised for safety	Some safety concern at the interface between FRA and the ATS route structure	Significant safety concern at the interface between FRA and the ATS route structure
DP7	**Technical (Flight Efficiency)** The interface between FRA and the ATS route network will maintain or improve flight efficiency compared to current day operations	B	The interface between FRA and the ATS route structure maintains or enhances flight efficiency	Some reduction in flight efficiency at the FRA and ATS route structure interface	Significant reduction in flight efficiency at the FRA and ATS route structure interface
DP8	**Technical (MoD Requirements)** The FRA airspace will be compatible with the requirements of the MoD and take into account the requirements of defence industry stakeholders	B	FRA is compatible with the requirements of the MoD	Minor elements of FRA are not compatible with the requirements of the MoD	Major elements of FRA are not compatible with the requirements of the MoD
DP9	**Technical (GA Impacts)** The impacts on GA and other civilian airspace users due to FRA will be minimised	B	Minimal impact to GA and other civilian airspace users	Minor impact to GA and other civilian airspace users	Significant impact to GA and other civilian airspace users
DP10	**Policy (AMS)** The proposed FRA airspace will fulfil the requirements of the AMS	A	Aligns with AMS	Partial alignment with AMS	No or limited alignment with AMS

[6] Note: due to the altitude of the proposed changes (>20,000ft), it is not expected that there will be any significant environmental impacts to stakeholders on the ground due to noise, visual intrusion and local air quality

DP11	**Implementation (Phasing)** The proposed FRA airspace will be suitable for introduction in a phased implementation	B	FRA implementation can be deployed in a phased manner	N/A	FRA implementation is either not achievable or only achievable in a single deployment
DP12	**Operational (Adjacent ANSPs)** Connectivity to adjacent airspace (FRA or non-FRA) will be maintained or enhanced	B	Connectivity is permanently maintained or enhanced	Connectivity is temporarily maintained or enhanced	Connectivity is reduced
DP13	**Operational (Capacity)** FRA will maintain current ATC capacity, and will aim to maximise airspace capacity	B	ATC capacity is maintained or enhanced	ATC capacity may be maintained or enhanced	ATC capacity is reduced
DP14	**Operational (Flexible Use Airspace)** The proposed FRA airspace will be compatible with the Flexible Use Airspace (FUA) concept	B	FRA is compatible with the FUA concept	Some elements of FRA are not compatible with the FUA concept	Significant incompatibility with the FUA concept

Table 2 DPE Assessment Criteria

5.2 The criteria in **Table 3** describe how each option's overall combination of reds/ambers/greens lead to the option progressing to the next step or to rejection and discounting from further development.

DP Priority	Criteria for Rejection Status
A	1 Red OR 1 Amber
B	2 Reds
C	2 Reds

Table 3 - DPE Accept / Reject Criteria

Option 0: FRA Baseline (do nothing)			REJECT
Description of option: Maintain the current airspace structure and route network with no free route capability			
DP	Description	Priority	DP Assessment
DP0	Safety Maintain or enhance current levels of safety	A	Met: Safety maintained. No improvement from today's operation
DP1	Operational (Resilience) The proposed airspace will maintain or enhance operational resilience of the ATC network	B	Met: Resilience maintained. No improvement from today's operation
DP2	Economic (Network Performance) The proposed FRA airspace will facilitate optimised network economic performance	B	Partially met: No change from today's operation
DP3	Environmental (CO_2 Emissions) The proposed FRA airspace will facilitate the reduction of CO_2 emissions per flight	B	Partially met: No change from today's operation
DP4	Environmental (Impact to Stakeholders on the Ground) Minimise environmental impacts to stakeholders on the ground	C	Met: No change from today's operation
DP5	Operational (Optimised Trajectories) Create an environment within which AOs may freely flight plan optimised trajectories between defined entry and exit points	B	Not met: AOs will have to flight plan to the existing route structure and therefore this DP is not met
DP6	Technical (Interface) The interface between FRA and the ATS route network will be optimised for safety	A	Not applicable: No interface if no FRA
DP7	Technical (Flight Efficiency) The interface between FRA and the ATS route network will maintain or improve flight efficiency compared to current day operations	B	Not applicable: No interface if no FRA
DP8	Technical (MoD Requirements) The FRA airspace will be compatible with the requirements of the MoD	B	Met: No change from today's operation
DP9	Technical (GA Impacts) The impacts on GA and other civilian airspace users due to FRA will be minimised	B	Met: No change from today's operation
DP10	Policy (AMS) The proposed FRA airspace will fulfil the requirements of the AMS	A	Not met: No change does not align with AMS
DP11	Implementation (Phasing) The proposed FRA airspace will be suitable for introduction in a phased implementation	B	Not applicable
DP12	Operational (Adjacent ANSPs) Connectivity to adjacent airspace (FRA or non-FRA) will be maintained or enhanced.	B	Met: No change from today's operation
DP13	Operational (Capacity) FRA will maintain current ATC capacity, and will aim to maximise airspace capacity	B	Met: No change from today's operation
DP14	Operational (Flexible Use Airspace) The proposed FRA airspace will be compatible with the Flexible Use Airspace (FUA) concept	B	Met: No change from today's operation, no impact on FUA

Table 4 Option 0: Baseline Design Principle Evaluation

5.3 Option 0 "Do nothing" has a Red for DP10 (priority A) so is rejected as a viable option.

Option 1: FRA with all ATS routes removed in FRA area			PROGRESS
Description of option: Remove all ATS routes within the FRA airspace			
DP	Description	Priority	DP Assessment
DP0	Safety Maintain or enhance current levels of safety	A	Met: Safety levels would be maintained.
DP1	Operational (Resilience) The proposed airspace will maintain or enhance operational resilience of the ATC network	B	Met: Resilience would be maintained
DP2	Economic (Network Performance) The proposed FRA airspace will facilitate optimised network economic performance	B	Met: Network economic performance would be optimised due to reduced track mileage
DP3	Environmental (CO_2 Emissions) The proposed FRA airspace will facilitate the reduction of CO_2 emissions per flight	B	Met: Average CO_2 per flight will be reduced due to track mileage reduction
DP4	Environmental (Impact to Stakeholders on the Ground) Minimise environmental impacts to stakeholders on the ground	C	Met: Environmental impacts to stakeholders on the ground would be no change; all changes above FL255
DP5	Operational (Optimised Trajectories) Create an environment within which AOs may freely flight plan optimised trajectories between defined entry and exit points	B	Met: AOs would be able to freely flight plan trajectories between defined entry and exit points
DP6	Technical (Interface) The interface between FRA and the ATS route network will be optimised for safety	A	Met: Interface will be optimised for safety. The design will rationalise interfaces through the removal of route structures
DP7	Technical (Flight Efficiency) The interface between FRA and the ATS route network will maintain or improve flight efficiency compared to current day operations	B	Met: Interface will improve flight efficiency through track mileage reductions
DP8	Technical (MoD Requirements) The FRA airspace will be compatible with the requirements of the MoD	B	Met: Minimal impacts. No changes to SUA structures or FUA principles
DP9	Technical (GA Impacts) The impacts on GA and other civilian airspace users due to FRA will be minimised	B	Met: Minimal impacts on GA and other civilian airspace users; all changes above FL255. No changes to TRA(G)s
DP10	Policy (AMS) The proposed FRA airspace will fulfil the requirements of the AMS	A	Met: Aligns with AMS element UK-ABN/1
DP11	Implementation (Phasing) The proposed FRA airspace will be suitable for introduction in a phased implementation	B	Met: This is the 3rd, but not final, implementation of FRA. Aligns with current FRA (D1)
DP12	Operational (Adjacent ANSPs) Connectivity to adjacent airspace (FRA or non-FRA) will be maintained or enhanced	B	Met: Connectivity will be enhanced, as the adjacent ANSP also operates FRA
DP13	Operational (Capacity) FRA will maintain current ATC capacity, and will aim to maximise airspace capacity	B	Met: Capacity would be maintained or improved
DP14	Operational (Flexible Use Airspace) The proposed FRA airspace will be compatible with the Flexible Use Airspace (FUA) concept	B	Met: Compatible with FUA concept, with FBZs utilised as required

Table 5 Option 1: FRA with all ATS routes removed Design Principle Evaluation

5.4 Option 1: FRA with all ATS routes removed is progressed as the only viable option. The next step will be Stage 2B Options Appraisal and initial safety assessment.

6. Initial Options Appraisal

6.1 In line with the requirements for a Level 2B change the environmental impact assessment has been conducted on the basis of CO_2 emissions. There would be no perceptible change to noise impacts to stakeholders on the ground, so no noise analysis has been conducted.

6.2 The implementation of Free Route Airspace (FRA) is mandated in UK law (Statutory Instrument Air Traffic Management Regulation (EU) 716/2014) and as such is not benefits driven.

6.3 Table 6 presents the assessment criteria for the option appraisal.

Group	Impact
Communities	**Noise impact on health and quality of life**
A qualitative assessment of changes to noise impacts compared with the 'Do Nothing' baseline. A qualitative assessment of changes to tranquillity impacts compared with the 'Do Nothing' baseline.	
Communities	**Air Quality**
A qualitative assessment of changes to local air quality compared with the 'Do Nothing' baseline.	
Wider Society	**Greenhouse Gas Impacts**
A quantitative & qualitative assessment of changes to greenhouse gas impacts compared with the 'Do Nothing' baseline.	
Wider Society	**Capacity / Resilience**
A qualitative assessment of changes to airspace capacity and resilience compared with the 'Do Nothing' baseline.	
General Aviation (GA)	**Access**
A qualitative assessment of changes to GA access compared with the 'Do Nothing' baseline.	
GA/Commercial Airlines	**Economic Impact from Increased Effective Capacity**
A qualitative assessment of changes to GA and commercial airline economic impacts from increased effective capacity compared with the 'Do Nothing' baseline.	
GA/Commercial Airlines	**Fuel Burn**
A quantitative & qualitative assessment of changes to GA and commercial airline fuel burn impacts compared with the 'Do Nothing' baseline.	
Commercial Airlines	**Training Costs**
A qualitative assessment of changes to commercial airline training costs compared with the 'Do Nothing' baseline.	
Commercial Airlines	**Other Costs**
A qualitative assessment of changes to other relevant commercial airline costs compared with the 'Do Nothing' baseline.	
Airport / ANSP	**Infrastructure Costs**
A qualitative assessment of changes to airport and ANSP infrastructure costs compared with the 'Do Nothing' baseline.	
Airport / ANSP	**Operational Costs**
A qualitative assessment of changes to airport and ANSP operational costs compared with the 'Do Nothing' baseline.	
Airport / ANSP	**Deployment Costs**
A qualitative assessment of changes to airport and ANSP deployment costs compared with the 'Do Nothing' baseline.	

Table 6 Initial Options Appraisal Assessment Criteria

6.4 The baseline (do nothing) option is not viable and was rejected at DPE as it does not meet the requirements of the AMS to introduce FRA in UK airspace, nor meet the mandated legal requirement to implement FRA in the UK UIR. It is included here as a comparison against the viable design option.

Option 0: BASELINE (Do Nothing)			
Group	Impact	Level of Analysis	Description
Communities	Noise impact on health and quality of life	Qualitative	The proposed changes to air traffic patterns are all above FL255 (circa 25,500ft). This is well above the 7,000ft threshold below which CAP1616 states noise impacts are considered significant and analysis is required. The potential noise or tranquillity impacts are neither measurable nor describable.
Communities	Air quality	N/A	ANG (2017) states "emissions from aircraft above 1,000ft are unlikely to have a significant impact on local air quality". No change in airspace design below 1,000ft – no changes to impacts.
Wider society	Greenhouse gas (GHG) impact	Qualitative / Quantitative	No changes to airspace; no change to GHG impacts.
Wider society	Capacity/ resilience	Qualitative	No changes to airspace; no changes to airspace capacity / resilience.
General Aviation	Access	Qualitative	GA access to the higher-level airspace above FL255 would be unchanged.
General Aviation/ commercial airlines	Economic impact from increased effective capacity	Qualitative	No changes to airspace; no impact on capacity.
General Aviation/ commercial airlines	Fuel burn	Qualitative	No changes to airspace; no change to fuel burn.
Commercial airlines	Training cost	Qualitative	No changes to airspace; no training cost impact.
Commercial airlines	Other costs	Qualitative	No changes to airspace, no impacts
Airport/ Air navigation service provider	Infrastructure costs	Qualitative	No changes to airspace, no impacts
Airport/ Air navigation service provider	Operational costs	Qualitative	No changes to airspace, no change in operational costs.
Airport/ Air navigation service provider	Deployment costs	Qualitative	No changes to airspace, no impacts

Table 7 Initial Option Appraisal: Baseline

Option 1: FRA WITH ALL ATS ROUTES REMOVED: This would implement FRA across the Deployment 3 area with all ATS routes removed. RAD restrictions would be introduced in order to manage the flow of traffic in complex areas and transitioning into and out of FRA.			
Group	**Impact**	**Level of Analysis**	**Description**
Communities	Noise impact on health and quality of life	Qualitative	The proposed changes to air traffic patterns are all above FL255 (circa 25,500ft). This is well above the 7,000ft threshold below which CAP1616 states noise impacts are considered significant and analysis is required. The potential noise or tranquillity impacts are neither measurable nor describable.
Communities	Air quality	N/A	ANG (2017) states "emissions from aircraft above 1,000ft are unlikely to have a significant impact on local air quality". No change in airspace design below 1,000ft – no changes to impacts.
Wider society	Greenhouse gas (GHG) impact	Qualitative /Quantitative	The introduction of FRA would enable a benefit of reduced GHG emissions. Flights would be able to plan the most direct route through the airspace (subject to structural limitations where required to maintain capacity) without the need to plan the existing routes. This enables individual flights to adapt their trajectories to consider not only distance and direction, but meteorological conditions and other factors which could improve efficiency. Initial analysis indicates a reduction in CO_2 emissions for the implementation year (2024) within a range of -7.6KT to -15.2KT. This modelling is based on EUROCONTROL flight plan data for a 6-day 2022 traffic sample using BADA 4.2. The range reflects the impact structural limitations may have on the FRA environment, which are still being developed at this stage.
Wider society	Capacity/ resilience	Qualitative	Increased flight planning flexibility would allow aircraft operators to flight plan more efficiently and would give them the option of avoiding capacity constrained areas. The ability to avoid restrictions by utilising alternative flight plan trajectories would reduce the likelihood of delay, thus improving the resilience of the wider network.
General Aviation	Access	Qualitative	GA access to the higher-level airspace above FL255 would be unchanged.
General Aviation/ commercial airlines	Economic impact from increased effective capacity	Qualitative	The introduction of FRA would not increase air transport movements, passenger numbers or cargo carried as an outcome of this proposal. The flight plan options this proposal would introduce could allow airlines to avoid capacity constrained areas and avoid consequential delay and cost. However, this is not quantifiable, and no specific capacity increase is assumed or claimed by this proposal.

General Aviation/ commercial airlines	Fuel burn	Qualitative /Quantitative	The introduction of FRA would enable a benefit of reduced fuel burn. Flights would be able to plan the most direct route through the airspace (subject to structural limitations where required to maintain capacity) without the need to plan the existing routes. This enables individual flights to adapt their trajectories to consider not only distance and direction, but meteorological conditions and other factors which could improve efficiency. Initial analysis indicates a reduction in fuel for the implementation year (2024) within a range of -2.4 to -4.8KT. This modelling is based on EUROCONTROL flight plan data for a 6-day 2022 traffic sample using BADA 4.2. The range reflects the impact structural limitations may have on the FRA environment, which are still being developed at this stage.
Commercial airlines	Training cost	Qualitative	There is not expected to be any airline training cost associated with FRA implementation.
Commercial airlines	Other costs	Qualitative	Updates to FMS and flight planning systems will be by the routine AIRAC updates. There are no other known costs which would be imposed on commercial aviation.
Airport/ Air navigation service provider	Infrastructure costs	Qualitative	The implementation of this FRA deployment is not expected to change airport or ANSP infrastructure impacts, beyond the initial deployment phase which will require some systems engineering amendments.
Airport/ Air navigation service provider	Operational costs	Qualitative	This proposal would not lead to changes in operational costs.
Airport/ Air navigation service provider	Deployment costs	Qualitative	Approximately 100 controllers would require training using the NATS simulator facility. Support staff are required to run the simulator – data preparation, testing, simulator setup, pseudo pilots, feed sector controllers, training staff, safety analysts, output to be collated into a sim report. Some operational support staff may require briefings. The reduced availability of operational controllers during their conversion training means that operational rostering becomes a factor when considering continuous service delivery. NB NATS cannot quantify training costs for other ANSPs; however, their acceptance of this proposal is a high-priority design principle. It is assumed that any such training costs are acceptable to these agencies.

Table 8 Initial Options Appraisal: Option 1 FRA with all routes removed

7. Safety Assessment

Options Appraisal Safety Assessment - Baseline

7.1 The proposed deployment area is adjacent to current Free Route Airspace (D1). The current operation within the deployment area uses a published route structure and airline operators flight-plan to follow available ATS routes or flight plannable Directs (DCT) as published in the Route Availability Document (RAD).

7.2 The published routes are supportive of strategic de-confliction between flights against active Special Use Airspace volumes (such as Danger Areas) and airspace with constrained radiotelephony or surveillance coverage. The routes also provide an operational framework that is conducive to Air Traffic Controllers' familiarity with traffic patterns, potential conflict points and practices for conflict avoidance/resolution. Flights into and out of the airspace volume (i.e. across boundaries with other Sectors and Air Traffic Control Units) are nominally managed via published waypoints.

7.3 In addition to flights following routes, some may be instructed to take a more direct path through the airspace. This is done in a tactical manner by Air Traffic Controllers based on their judgement that a different path can be followed safely.

7.4 Air Traffic Controllers are supported in their task by equipment functionality (tools) that includes prediction of the trajectories that aircraft will follow. Predicted trajectories can be viewed by Controllers, and the tools use the former to identify potential areas of conflict between aircraft for Controllers' attention. The tools also monitor the conformance of aircraft to their expected trajectories and highlight deviations. The tools support the Controllers in ensuring that the aircraft pass through the airspace safely separated from other aircraft, Danger Areas etc.

Options Appraisal Safety Assessment – Current Position

7.5 Project activities so far have included a Key Assurance Risk review and a Pre-Simulation Hazard review prior to the planned Real Time Development Simulation (planned for April 2023).

7.6 The initial work[7] that has been done has indicated that the Air Traffic Controllers regard the FRA mode of operation as being similar to that experienced today, in particular similar with the current FRA D1 already in operation since December 2021. Key factors underlying this are that direct routings that are (tactically) provided today are expected to be reflected in flight plans and that the tools will continue to support Controllers in foreseeing and resolving potential conflicts. Although reduced familiarity as to where conflicts may occur is a possibility (due to the ability to flight plan user-preferred trajectories) the tools are designed to provide adequate support in discerning and managing changes in this aspect.

7.7 It is expected that the existing level of safety performance undertaken within the current operation would be maintained. This would be verified, and assurance provided in further stages of the project.

[7] It has not yet been possible to fully involve all ATC parties (such as the Military) or to exercise the final form of equipment functionality.

8. Conclusion and Next Steps

8.1 FRA is a legally mandated concept, which is a key aspect of the UK Airspace Modernisation Strategy. The concept of FRA enables environmental efficiencies. This is the 3rd deployment of FRA within UK airspace, and this proposal has been developed to meet the Statement of Need submitted to the CAA for this deployment.

8.2 NATS propose there is only one design option: Deploy FRA Option 1 to implement FRA with all routes removed, within the proposed deployment area. This design aligns with current FRA, optimising safety and efficiency. It meets the legal mandate, and the AMS requirements.

8.3 NATS has engaged extensively on the development of FRA, and for this deployment has conducted two-way engagement with ANSPs, CFSPs, airlines, MoD, and GA stakeholders. The outcome of this engagement has shown stakeholders are in support of the proposed design option.

8.4 The lateral boundaries are limited by the technological constraints described. The lower vertical boundary is FL255, to align with FRA D1, ensuring efficient FRA with minimal complexity and cost on the current technology platform. An initial appraisal of this indicates environmental benefits and a reduction in flight planning complexity.

8.5 The baseline (do nothing) does not comply with the CAA's Airspace Modernisation Strategy or the UK's legal obligations to deliver FRA, so is not a viable option.

8.6 Subject to CAA approval at the Stage 2 Gateway Assessment, this proposal will move on to Stage 3 – Consult.

9. Glossary of Terms

Baseline: The current "Do Nothing" situation against which proposed changes are measured

Borealis Alliance: Alliance amongst north-west European Air Navigation Service Providers to drive better performance for stakeholders through business collaboration. The Alliance includes the ANSPs of Denmark, Estonia, Finland, Iceland, Ireland, Latvia, Norway, Sweden and the UK.

CAP: Civil Aviation Publication - publications produced by the CAA

COP: Coordination Point. Points on the UIR boundary, traditionally used for flight plans where a flight transitions between the ANSP of the UK to/from that of the bordering country.

DCT (Direct routing): Waypoint to waypoint routing, which does not use an airway.

EUROCONTROL: European Organisation for the Safety of Air Navigation; with 41 members it seeks to achieve safe and seamless air traffic management across Europe.

FBZ: Flight Plan Buffer Zones – areas for flight planners to avoid, providing separation from Special Use Airspace.

FIR: Flight Information Region (Airspace below FL245)

FL: Flight level, the altitude reference which aircraft use at higher altitudes using standard pressure setting, essentially units of 100ft, i.e. FL245 equates approximately to 24,500ft

FRA: Free Route Airspace

ICAO: International Civil Aviation Organisation – an agency of the United Nations.

LAMP: London Airspace Modernisation Programme; established to redesign the airspace in and around the London TMA region, providing a more efficient airspace design, modernising the route structure and making better use of aircraft and ATC technologies.

NPZ: No Planning Zones – areas where a flight plan is not permitted to enter at all or only when meeting prescribed criteria.

RAD: Route Availability Document: contains the policies, procedures and descriptions for route and traffic orientation. Includes route network and free route airspace utilisation rules and availability.

SESAR: Single European Sky ATM Research. A collaborative project to modernise airspace and air traffic management across Europe to common standards

SUA: Special Use Airspace – areas designated for operations of a nature that limitations may be imposed on aircraft not participating in those operations (i.e. military training areas)

UIR: Upper Information Region (Airspace above FL245)

Appendix A: List of Targeted Stakeholders

Airlines (52)

Aer Lingus	FedEx	Saudi Arabian Airlines
Air Canada	Finnair Plc	Scandinavian Airlines - SAS
Air France	GAMA Aviation	Scandinavian Airlines - SAS - Ireland
Air Transat	Iberia Airlines	Singapore Airlines Ltd
AirTanker Services Ltd	Icelandair	Swiss
American Airlines	Jet2.com	TAG Aviation (UK) Ltd
Austrian Airlines	JetBlue	TAP
Azerbaijan Airlines	KLM Royal Dutch Airlines	Titan Airways
BA CityFlyer	Loganair Ltd	TUI Airways
British Airways PLC	Lufthansa	Turkish Airlines
Cargolux Airlines	Lufthansa Cargo	United Airlines Inc.
CityJet	Malaysia Airlines	UPS Airlines
Delta Air Lines	NetJets	Virgin Atlantic Airways Ltd
DHL Air Limited	Norwegian Air International	WestJet
Eastern Airways	NOVAIR	Wizz Air Hungary Ltd
easyJet	Qatar Airways	Wizz Air UK
Emirates Airlines	Qantas	
Etihad Airways	Ryanair	

ANSPs (4)

MUAC	Eurocontrol CFMU	Borealis Alliance Executive
NAVAIR		

CFSPs (7)

Air Support	Lido/ Lufthansa Systems	NavBlue
Flight Keys	Jeppesen	Sabre
Aviation Cloud		

NATMAC (28)

Airlines UK	Airspace 4All	AEF (Aviation Envt Federation)
AOA (Airline Operators Assoc)	AOPA (Aircraft Owners & Pilots)	ARPAS-UK
BAE systems	BALPA (Airline Pilots Assoc)	BBAC (Balloon & Airship Club)
BBGA (British Business & GA)	BGA (British Gliding Assoc)	BHA (British Helicopter Assoc)
BHPA (Hang gliding & Paragliding Assoc)	BMAA (Microlight Aircraft)	BPA (British Skydiving Assoc)
European UAV Systems	GASCO	Drone Major
GATCO	HCGB (Helicopter Club GB)	GAA (GA Alliance)
Honourable Co. Air Pilots	Iprosurv Drone Pilot Network	Heavy Airlines
Low Fares Airlines	DAATM (MoD)	LAA (Light Aircraft Assoc)
		PPL/IR

Other (8)

Airlines for America	AIRE	AOC Heathrow
BAR UK (Board of Airline Reps)	UKSA (UK Space Agency)	Black Arrow Space Tech

Airports (14)

Edinburgh	Glasgow	Manchester
Liverpool	Prestwick	East Midlands
Coventry	Birmingham	Leeds Bradford
Doncaster	Teesside International	Newcastle
Hawarden	Humberside	

End of document